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11.0 Drainage Element

Development and urbanization affect the native hydrologic cycle, ecology and drainage patterns that exist in nature. The natural biologic and geologic systems are adapted to, and altered by, the climatic and hydrogeologic regimes of a locale. As human activity disturbs this balance by removing vegetation, altering topography and increasing imperviousness, the intensity and frequency of damaging storm water runoff increases, as does the resulting erosion and flooding. Urbanization also alters the chemical composition of runoff. As rainfall washes over buildings, lawns, roadways, and parking lots, it carries away the detritus of human activity and absorbs anthropogenic compounds from pesticides, fertilizers, metals and petrochemicals.

These consequences of human habitation and activity require that stormwater be controlled and managed to mitigate the adverse effects on the environment and to safeguard life and property. This element provides an inventory and analysis of existing stormwater management systems and practices in Monroe County. Based upon this analysis, the subsequent Goals, Objectives and Policies contained within the Comprehensive Plan Policy Document outline the growth management strategies necessary to correct existing deficiencies and accommodate future development.

11.1 Terms and Concepts

11.1.1 Stormwater Runoff

A certain amount of rainfall is converted to water flowing over land during and immediately following a storm event. Under the effects of gravity, the runoff flows toward sea level through depressions and channels which comprise the drainage system of an area. The drainage system may consist of natural features, artificial features or a combination of both. The occurrence of stormwater runoff is highly variable, depending upon the amount of rain falling during each storm event and on the conditions within the drainage basin. Since most storm events are relatively moderate, natural drainage features typically evolve to accommodate moderate quantities of stormwater runoff. Severe storm events create runoff volumes in excess of what these features can handle, resulting in temporary flooding of adjacent land.

11.1.2 Infiltration

As rain falls to the ground it is initially absorbed by the topsoil and percolates downward through the soil matrix until the ground is saturated and runoff begins at the surface. This process is referred to as infiltration.

11.1.3 Impervious Surface

Natural topography varies in its ability to absorb rainfall through infiltration. The greater the degree of imperviousness, the greater the percentage of rainfall that will appear as runoff. Urbanization increases the imperviousness of a watershed by covering the ground with hard surfaces such as buildings, roads and parking lots, and thereby increases the quantity and frequency of runoff, also degrading the quality.

11.1.4 Stormwater Management System

A stormwater management system is the collection of facilities, improvements or natural systems whereby stormwater runoff is collected, controlled, conveyed, impounded or obstructed. Stormwater management facilities are designed to ensure that the volume, rate, timing and pollutant load of runoff after development is similar to that which occurred under natural conditions.

11.1.5 Best Management Practices (BMP's)

Best Management Practices (BMP's) are the techniques applied to manage stormwater runoff. These are selected to be the most effective and economical combination of structural, operational and regulatory practices for local conditions. Stormwater Management practices are regulated in Monroe County by the South Florida Water Management District (SFWMD).

11.1.6 Design Storm

A design storm is a rainfall event of a particular duration and frequency which a stormwater management system must be designed to accommodate. The selection of a standard design storm balances the cost of structures needed to avoid flooding against the savings from reduced flood damage. Typically, a 24-hour, 25-year return frequency storm is used. Runoff from a development project is required to be limited to amounts that will not cause adverse off-site impacts. In most cases, the peak rate of discharge from a developed site is limited to the historic rate of runoff from the site in an undeveloped condition.

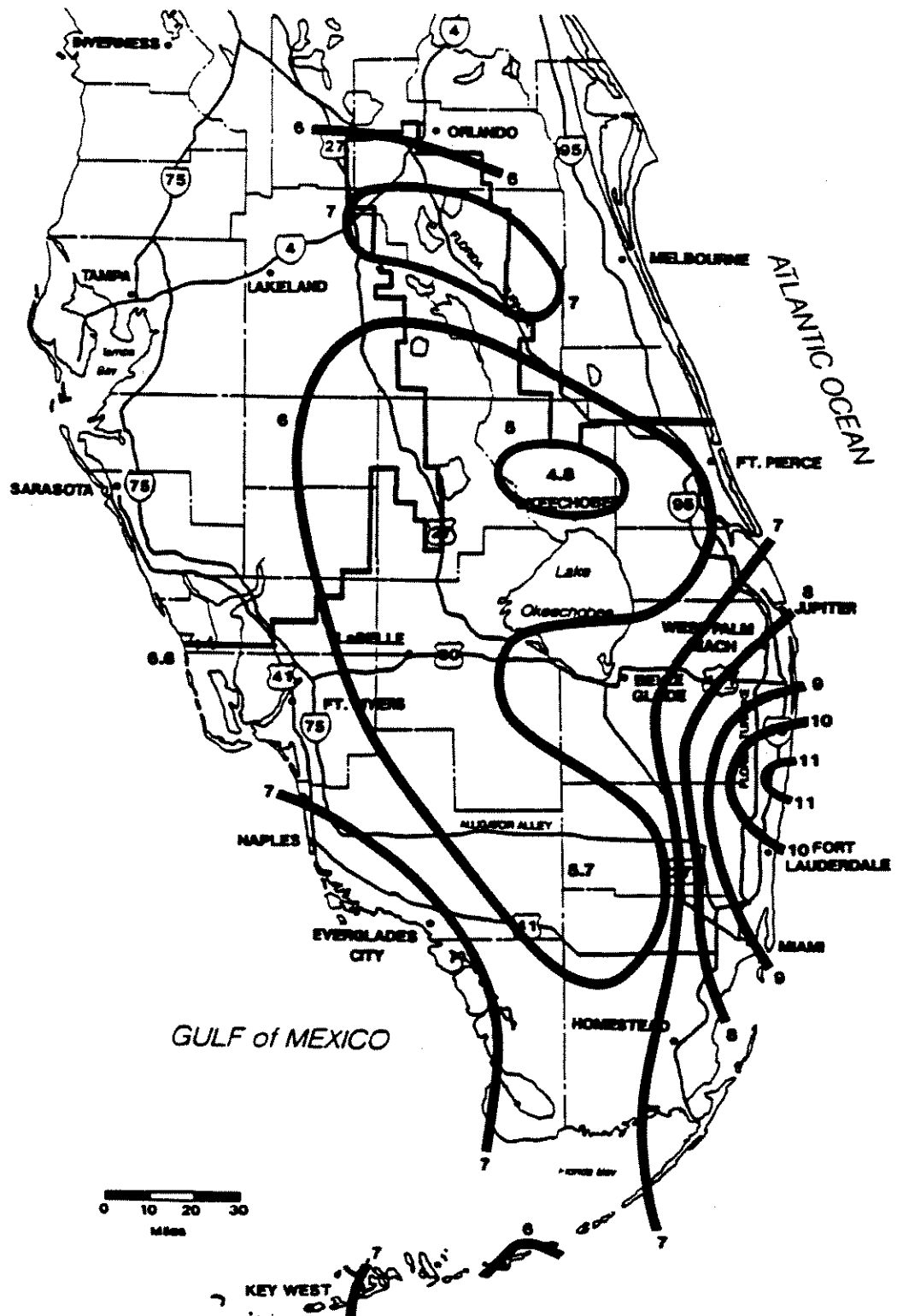
11.2 Climate and Rainfall

Monroe County has a mild, subtropical climate with an average temperature of about 77 degrees Fahrenheit, and seasonal deviation of monthly mean temperatures of only about 10 degrees Fahrenheit. Dominated by the trade winds, the Keys receive approximately 65 percent of the average annual 38 inches of rainfall during the wet season from May to October. The prevailing winds are from the southeast during spring and summer, and from the northeast in fall.

The wet season is dominated by large convective thunderstorms with an average frequency of every third day. During the winter months most rainfall results from rapidly moving cold fronts which pass through the region approximately once a week.

The SFWMD uses rainfall maps for 24-hour duration storms of various return frequencies. These maps are used to determine the depth of rainfall in inches for use in the design and analysis of stormwater management systems. Figures 11.1 and 11.2 present the maps for the 10-year and 25-year return frequency storms.

The Florida Department of Transportation (FDOT) also uses rainfall data to design and permit storm drainage along the agency's facilities. Figure 11.3 presents the FDOT Duration-Intensity curves for Zone 11, which includes the Florida Keys.



Source: South Florida Water Management District, 1967

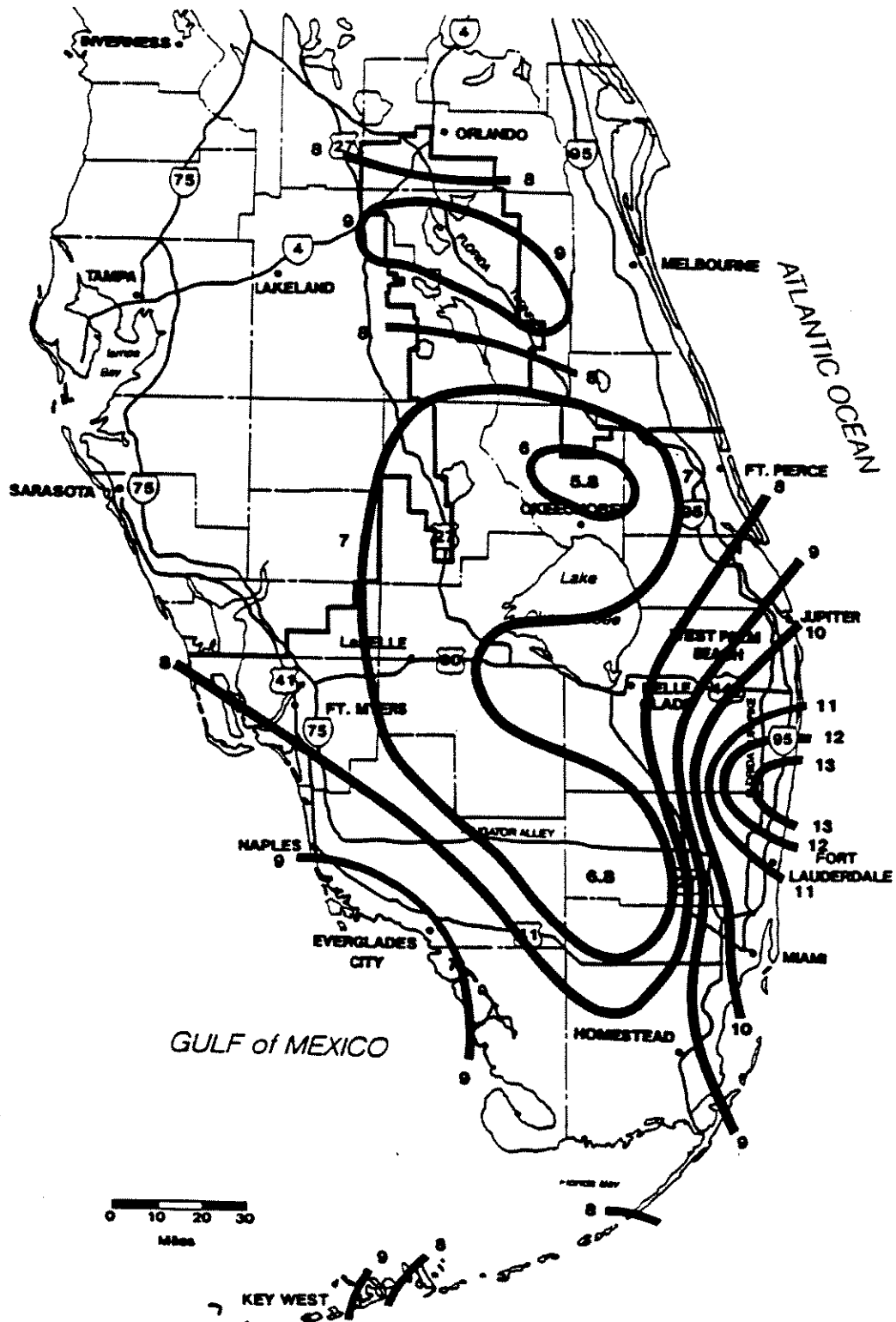


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Monroe County Year 2010 Comprehensive Plan

10 Year, 24 Hour
Rainfall

Figure
11.1



Source: South Florida Water Management District, 1987

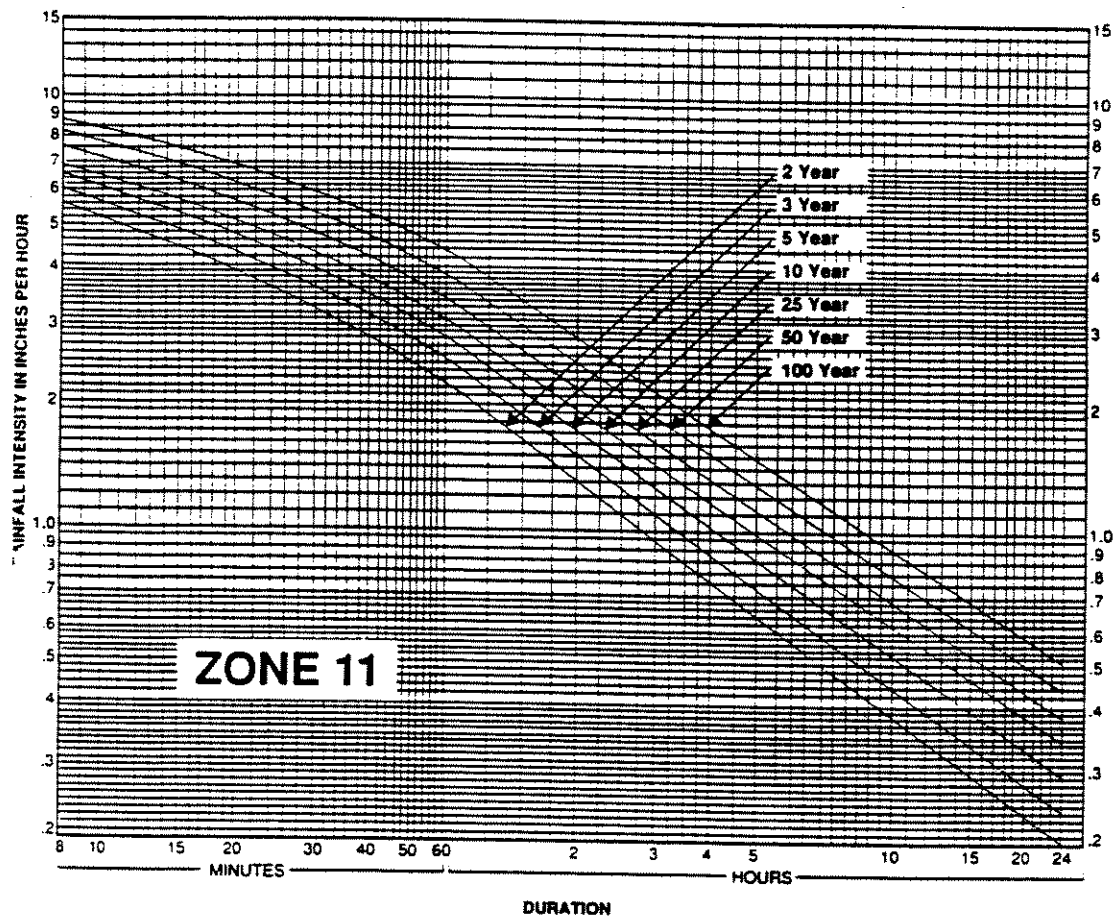


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Monroe County Year 2010 Comprehensive Plan

**25 Year, 24 Hour
Rainfall**

**Figure
11.2**



Source: Florida Department of Transportation, 1987



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**Monroe County
Year 2010
Comprehensive Plan**

**FDOT Duration-
Intensity Curves**

**Figure
11.3**

11.3 Regulatory Framework

11.3.1 Federal Regulations

In 1987 Congress re-authorized PL92-500, the Federal Water Pollution Control Act (the "Clean Water Act") (CWA). Section 208 of the CWA had been the traditional means of addressing pollution abatement and water quality since 1972. In 1987 Congress also enacted the Water Quality Act (WQA). The WQA contains three provisions which specifically address stormwater discharges and sets forth the permitting criteria for municipal and industrial stormwater discharges. The central provision governing stormwater is Section 405 which adds Section 402(p) to the CWA and establishes the general role and exceptions for municipal and industrial stormwater discharges. At this writing, the EPA is still in the process of promulgating rules for the application of National Pollution Discharge Elimination System (NPDES) permit programs to stormwater discharges. While the initial focus of the EPA rules to date is industrial and large urban systems (greater than 100,000 population), the federal mandate for regulating all stormwater discharges on a system-wide basis is clear and inevitable.

11.3.2 State Regulations

The State of Florida has designated the SFWMD to regulate surface waters within the district that includes all of Monroe County. Under Part IV of Chapter 373, Florida Statutes, and Rules Chapter 40E-4, and 40E-40, F.A.C., the SFWMD is responsible for permitting the construction and operation of surface water management systems. Additionally, the SFWMD has been delegated stormwater quality responsibility by the Florida Department of Environmental Regulation (DER) under Chapter 17-25 F.A.C.

The SFWMD is divided into two separate basins: the Big Cypress Basin and the Okeechobee Basin. Each basin has a separate governing board that plans and approves projects within the respective basin. A portion of mainland Monroe County lies within the Big Cypress Basin, but the majority of the County is in the Okeechobee Basin. The major drainage basins of South Florida are shown on Figure 11.4.

The DER is the primary environmental regulatory agency in the state of Florida and has the authority under Chapter 403 F.S. to classify waterbodies and to regulate discharges to ensure that they are appropriate to the waterbody's designation. The DER has classified much of Florida Bay and the reef track as "Outstanding Florida Waters" (OFW) affording these areas state protection. Rule amendments recently proposed by the DER envision a new water quality classification: "Outstanding National Resource Waters." The proposed rules would impose an anti-degradation standard for designated water bodies. The Everglades National Park (including a large portion of Florida Bay) is among those water bodies included in the proposed rule's designations of Outstanding National Resource Waters.

In addition to the foregoing regulations, the FDOT independently permits stormwater discharges and connections to Department rights-of-way under Chapter 14-86 F.A.C.

11.3.3 Local Regulations

In the past, the only controls on stormwater imposed by the County were those involving flood protection and floodplain encroachment as established in Section 9.5-293 of the County Code. The Monroe County Planning Department is in the process of developing a Request for Qualifications entitled "For the Development of Criteria Aimed at Controlling the Quality and Quantity of Stormwater Discharges from

new and existing Duplex and Single Family Home Development in Monroe County, Florida, and to provide Information for Distribution to the General Public Explaining the County's Proposed Stormwater Management Ordinance." This ordinance would meet the intent of Section 9.5-293.1 and, unlike the existing code, would address retrofitting of existing facilities or redevelopment activities.

At this writing the Department of Community Affairs (DCA) has not yet approved the new ordinance, pending final approval of the County action under the Area of Critical State Concern designation. The DCA objections presumably will be resolved to ensure adoption of Section 9.5-293 as part of the County's revised Land Development Regulations in October of 1992.

Although the jurisdiction of the new regulations will comply only to the unincorporated area of the County, municipalities within Monroe County are required to adopt compatible ordinances within twelve months of enactment. The municipalities of Key Colony Beach and Layton have already adopted these regulations and Key West will adopt revised Land Development Regulations pending adoption of its Comprehensive Plan.

In conjunction with Section 9.5-293, the County has prepared a Manual of Stormwater Management Practices which provides information on acceptable forms of BMP's. This document was prepared with the assistance of the South Florida Regional Planning Council (SFRPC) and the SFWMD and includes BMP's consisting of rate control structures, catch basins with skimmers and baffles, and wet and dry detention/retention facilities.

11.4 Existing Facilities

11.4.1 The Keys

The last thirty years have witnessed rapid growth in Monroe County as development has spread beyond the confines of Key West and Key Largo. Over this period the unincorporated sections of the County have been transformed from very isolated and rural to increasingly urbanized.

Because of the combination of the proximity of the ocean, dense vegetation and permeable soil, the citizens of Monroe County have traditionally given little concern to stormwater runoff. Most rainfall readily infiltrates the undifferentiated sands that comprise the soil of the Florida Keys. In the Upper and Middle Keys these sands are underlain by the highly permeable Key Largo Limestone. In the Lower Keys the upper stratum of bedrock is Miami Oolite, which, while very porous, has a low permeability.

The Key Largo Limestone is a highly permeable remnant of a prehistoric reef. This formation is filled with caverns and solution holes that allow tidal sea water to move freely in and out of the rock structure. Rainfall quickly permeates the rock and combines with the sea water.

The Miami Limestone (oolite) outcrops at the surface in the Lower Keys. This formation is also a very porous, solution riddled, rock. The vertical permeability of the Miami Oolite is extremely high, but many of the solution pipes are not interconnected leading to a much lower horizontal permeability. This low horizontal permeability limits the inter-mixing of rainfall and sea water and gives rise to the fresh water lenses found in some of the Lower Keys.

Historically, drainage works in Monroe County have been the sole concern of the developer or property owner. Dredge spoil from canal construction was used to fill low areas and mosquito ditches were cut to drain native wetlands. Boat canals were treated as primary drainage facilities with building sites draining directly into them by sheet flow, minor ditches or percolation.

The dredging of navigable canals and borrow pits has also had an effect on the hydrologic regime of the Florida Keys. Besides the obvious impact to the landscape, such activities can have widespread off-site effects. Because canal cuts open new interfaces between the ocean and groundwater, they can have dramatic hydrogeologic consequences. The excavation of drainage canals can lower water surface levels over considerable distances. Such reduction in groundwater may have dramatic effects on wetlands and may also diminish the available soil moisture of upland systems.

The DER estimates that there have been over 700 canals and numerous access channels dredged in the Florida Keys. Many of these canals and access channels serve the approximately 100 private and public marinas as well as numerous residential areas.

Ditches along US 1 have served as primary drainage systems on several Keys, transporting stormwater along the axis of the highway to the ocean. Much of US 1 lacks any drainage system. The highway was constructed on an old railroad with little improvement other than pavement installation. Key Largo, Islamorada and other urbanized segments of US 1 have limited storm drainage systems. In 1989, as part of a major roadway project on the island of Marathon, the FDOT installed storm sewer and retention basins adjacent to US 1.

The overriding stormwater concern for residents of Monroe County has always been the low-lying topography with the threat of inundation by hurricane-driven storm surges. Virtually the entire landmass of the Florida Keys lies within the 100-year flood plain designated by the Federal Emergency Management Agency (FEMA) and is classified as an area of special flood hazard. (See Chapter 3.0, Conservation and Coastal Management Element).

11.4.2 The Mainland

The mainland segment of the County has been largely ignored by development interests because it consists solely of the vast system of marshes, sloughs, tree islands and cypress forests known as the Everglades. This indifference has not, however, protected this wilderness from the effects of human activity. Much of mainland Monroe County was incorporated into the Everglades National Park which was created in 1947. Also in 1947, the U.S. Army Corps of Engineers undertook the Central and Southern Florida Flood Control Project (C&SFFCP). This extensive network of canals and control structures was intended to meet the needs of flood protection, drainage and irrigation of farmland, and water supply to the urban areas along the coast. Although none of the C&SFFCP improvements are within Monroe County, the project modified the hydrology of the Shark River Slough, Rocky Glades, Taylor Slough and Broad River which serve as headwaters to the Everglades National Park.

Completed in the 1960s, the C&SFFCP had unfortunate consequences for the Everglades National Park. This management system altered the hydroperiod of the Everglades, exacerbating droughts and extending inundations. The C&SFFCP also altered the pattern of nutrients carried in the fresh water and transported

agrichemicals from the Everglades Agricultural Area through the Everglades National Park and into Florida Bay.

The SFWMD has recently prepared a draft of a comprehensive Surface Water Improvement and Management Plan (SWIM) for the Everglades. This program has the following stated goals:

Water Conservation Areas: Protect and improve the natural resources of the Water Conservation Areas (WCA's) as an integral part of the Everglades system while maintaining the multiple functions of the WCAs.

Everglades National Park: Provide adequate timing, distribution and flow of rainfall-quality water (phosphorus concentrations equal to or less than 0.03 mg/l) to the Everglades National Park (ENP) which will maintain and perpetuate natural southern Everglades habitats and functional ecosystems.

C-111 Basin: Manage the C-111 Basin to protect environmental resources and maintain existing public uses, and to provide more natural hydroperiod and flow conditions and adequate water quality to the basin's wetlands, coastal estuaries and the ENP.

Florida Bay: Protect and improve natural surface water quality, quantity, distribution and timing of water flowing into Florida Bay through the ENP, the C-111 and the Florida Keys so as to maintain the ecosystem integrity and habitat diversity of the receiving waters.

The SWIM plans detail several major problems affecting Florida Bay and the Florida Keys. These issues include water quantity flow and increased salinity, water quality and nutrient loads, fish and wildlife resource management, water supply and public access.

11.4.3 Performance Assessment

A. Water Quantity

Little documentation about the design or implementation of drainage improvements in Monroe County exists. The absence of flooding problems and inference of adequate capacity is based upon the personal knowledge of local residents. In the past, the FDOT has used a three-year frequency event of critical duration for the design of its facilities within Monroe County. More recently the FDOT used a 25-year frequency for design of the Marathon US 1 highway improvements.

The Soil Conservation Service recently completed the fieldwork for compilation of the first comprehensive soil survey of Monroe County. The delineation of soil types compiled in this survey will provide an important tool in the analysis and design of future systems and assist in the assessment of potential problem areas. Existing soil types in the Florida Keys are illustrated on the Soils Map series of the Map Atlas.

B. Water Quality

In 1988 the DER prepared an assessment of nonpoint source pollution for the entire state in conjunction with the 205(j) water quality assessment program. The data collected in the Florida Keys was extremely limited and insufficient to distinguish potential stormwater problems. The assessment, however, did show degradation of water quality in urbanized areas.

The County has recently commissioned two research projects through the Florida Keys Land and Sea Trust to investigate groundwater and nearshore water quality. This research, though still limited in scope, has demonstrated water quality problems of varying severity throughout the study area. The primary pollution mechanism identified by the authors of these studies is groundwater flushing of septic tank effluent into canals. While these studies made no direct correlation to stormwater, the role of infiltrating runoff as a transport media may be inferred from the hydrogeology of the Florida Keys. A detailed discussion of water quality issues is presented in Section 3.5.2 of the Conservation and Coastal Management Element.

11.5 Surface Water Management

The major impact of inadequate draining facilities upon surrounding natural resources is that associated with flooding and stormwater runoff. Rapid runoff of stormwater results in the loss of valuable freshwater resources, and may have other ecological impacts as well. Further, potential recharge capabilities of natural water systems have been lost or greatly diminished, due to the lack of stormwater drainage practices throughout the County.

Development associated with urbanization increases runoff by increasing flow velocity and flow volume due to the characteristics of impervious surfaces. Flow velocity and volume increase significantly when the path is changed from rough surfaces, such as woodland, grassland, or natural channels to smoother surfaces, such as parking lots. The creation of large expanses of impervious surfaces also prohibits water storage in the soils they cover. In this manner the problem is compounded since natural water storage capacity is lost while stormwater runoff is increased.

Urban development covers large areas of land with impervious surfaces which inhibit the ground's ability to absorb rainfall and increases stormwater runoff. This increased amount of runoff places greater stress on the natural drainage system, which results in increased probability of flooding during periods of heavy rainfall.

11.5.1 SFWMD Permitting Practices

The permitting of surface water management systems by the SFWMD is specified in Chapter 373, Part IV, F.S. which regulates the construction, alteration, maintenance and operation of most real property improvements which are designed to control surface waters. An applicant for a surface water permit must show that the proposed project is consistent with the goals and policies expressed in Chapter 373.016, F.S. (Declaration of Policy) and Chapter 373.016, F.S. (State Water Use Plan), and must demonstrate that construction or alteration of the surface water management systems will not be harmful to the water

resources of the SFWMD. In addition, the operation and maintenance of the systems cannot be inconsistent with the overall objectives of the District or be harmful to the water resources of the District.

Documentation of existing conditions is, at the present time, limited to General and Individual Surface Water Management Permits issued by the SFWMD. A general SFWMD surface water management permit is applicable to development which is less than 40 acres in size and limited site activities such as upland clearing, earthwork and lake construction. An individual SFWMD surface water management permit is generally applied to sites greater than 40 acres. An individual surface water management permit must be approved by the SFWMD Governing Board. SFWMD issues exemptions from obtaining a general permit for projects less than 10 acres of total land area and less than 2 acres of impervious surface. Projects issued permits by the SFWMD are listed in Table 11.1. The locations of the permits are illustrated in the Drainage Map series of the Map Atlas.

Chapter 40E-4, F.A.C. describes the permit requirements for construction, alteration or operation of surface water management systems. To satisfy the permit requirements an applicant must either receive an individual permit or qualify for a general permit. Individual permits are issued by the Governing Board upon application and compliance with Part IV of Chapter 363, FS and Chapter 40E, F.A.C. with specific permitting criteria found in 40E-4.091, F.A.C. General permits are issued by Rule for most projects and certain types of highway construction. To qualify for a general permit, an applicant must file the notice specified in the rules, a copy of the project construction plans and basic technical data about the project such as proposed minimum road and floor elevations, proposed discharge rate, retention/detention volume and facilities. Upon receipt of this information the District determines whether the project qualifies for a general permit and/or if any additional information is needed. Once the District has indicated that the general permit is in effect for the project, no further application is required. Individual and general permits are subject to revocation, suspension or modification in accordance with the provision of Chapter 40E, F.A.C. and Chapter 373, FS. SFWMD regulates stormwater discharge and water treatment quality through the provisions contained in Chapter 17-25, F.A.C. which are the SFWMD stormwater discharge regulations.

As previously indicated, the County has little data related to existing natural and man made drainage features. Historically, given the location and configuration of the Keys and the unlimited outfall capacity of the surrounding water bodies, relatively little consideration has been given to stormwater runoff. There is concern that this history of unregulated stormwater runoff contributes to a portion of the nearshore water nutrient and sediment loading. Recent regulatory developments have caused increased focus on stormwater management practices most specifically related to the treatment and quality of stormwater runoff. Designation of the Keys as an Area of Critical State Concern (ACSC) (Chapter 380.0552 FS 1974 and designation of the surrounding waters as Outstanding Florida Waters (OFW) (Chapter 17-25 F.A.C.) in 1985 required that a county-wide comprehensive water quality monitoring program be established. To date water quality monitoring and data analysis has been limited to short-term specific studies.

TABLE 11.1
South Florida Water Management District
Surface Water Management Permits
Unincorporated Monroe County

Map No.	Permit No.	Receiving Body	Land Use	Acreage	Location Sec/Twp/Rng
1	GP-83-186	*	Hwy	*	34/67S/25E
2	GP-83-199	*	Hwy	*	22/67S/26E
3	GP-44-00078	Gulf of Mexico	Comm	2.90	29/67S/25E
4	44-00038	Gulf of Mexico	Res	56.00	14,15,23/67S/26E
5	GP-44-00047	Lower Sugarloaf Sound	RV	11.47	8/67S/27E
6	GP-44-00050	Florida Bay	Landfill	20.00	19/66S/28E
7	GP-86-119	*	Hwy	*	32/66S/29E
8	GP-83-120	*	Comm	*	26/66S/29E
9	GP-44-00004	Groundwater	Comm	8.8	23/66S/29E
10	GP-87-12	*	Hwy	*	4/66S/29E
11	GP-44-00102	Boot Key Harbor	Comm	9.33	10/66S/32E
12	GP-44-00044	Gulf of Mexico	Comm	10.00	10/66S/32E
13	GP-83-69	Retention Pond	Hwy	*	4,5/66S/33E
14	GP-44-00091	Atlantic Ocean	Res	14.00	14/66S/32E
15	GP-85-101	Tidal	Comm	*	11/66S/32E
16	44-00113	On-site	Comm	197.4	1/66S/32E
17	GP-84-75	*	Hwy	*	6/66S/33E
18	44-00045	Gulf of Mexico	Res	43.8	5,6/66S/33E
19	GP-44-00087	On-site	Res	22.3	35/65S/33E
20	GP-83-5	*	Hwy	*	25/65S/33E
21	GP-83-5	*	Hwy	*	33-35/65S/33E
22	86-238	On-site	Comm	60.8	21/65S/34E
23	GP-78-71	*	Comm	*	5,6/65S/35E
24	GP-84-4	*	Hwy	*	11,14,15,20,22/64S/34E
25	GP-44-00160	FL Bay/Atlantic Ocean	Hwy	21.8	5,6,32/64,63S/37E
26	GP-44-00107	On-site	Res	5.76	21/64S/36E
27	GP-86-66	On-site	Comm	*	32,33/63S/37E
28	GP-44-00156	*	Hwy	*	22,27,28/63S/37E
29	GP-84-29	*	Hwy	*	18/63S/38E
30	GP-44-00007	Atlantic Ocean	Res	12.56	7,8,18/63S/38E
31	GP-87-82	Atlantic Ocean	Hwy	30.32	18/63S/38E
32	GP-86-120	On-site	Comm	*	8/63S/38E
33	GP-44-00088	On-site	Comm	0.69	33/62S/38E
34	44-00036	Atlantic Ocean	Res	69.4	26,27/62S/38E
35	GP-44-00053	Florida Bay	Res	13.7	6,7/62S/39E
36	GP-44-00092	On-site	Comm	4.2	33/61S/39E
37	GP-44-00006	Atlantic Ocean	Res	29.22	32,33/61S/39E
38	GP-83-114	*	Comm	0.75	28/61S/39E
39	GP-44-00040	Buttonwood Sound	Res	24.0	28/61S/39E

Map No.	Permit No.	Receiving Body	Land Use	Acreage	Location Sec/Twp/Rng
40	GP-44-00041	On-site/Tidal	Comm	25.18	22/61S/39E
41	GP-44-00104	*	Hwy	83.66	1,6,11-15/61S/39,40E
42	GP-44-00119	*	*	*	11/61S/39E
42	GP-83-115	*	Res	8.15	12/61S/39E
44	GP-44-00122	*	*	*	1/61S/39E
45	GP-44-00108	*	*	*	47-50/60S/40E
46	44-00005	On-site Lakes	Res/Comm	33.4	31,32/60S/40E
47	GP-78-190	*	Hwy	*	20,21,29/60S/40E

* Information Unavailable

Missing Documents from SFWMD Files:

Permit No.
85-0074
44-00039
44-00051
44-00054
44-00124
44-00136
44-00142
44-00003
44-00147
44-00148
77-84

Source: South Florida Water Management District, 1991

11.5.2 Needs Assessment

A. Stormwater Management Master Plan/Stormwater Utility

At the present time, only project specific surface water management systems exist in Monroe County that are capable of servicing existing land use or mitigating associated impacts. A facility-specific land use inventory has not been completed to ascertain the drainage system needed to serve a combination of residential, commercial, industrial, extractive, institutional and agricultural land uses as well as public facilities, conservation/preservation areas and vacant lands.

Similarly, a comprehensive analysis of current demand and projected needs for stormwater management facilities, which would include future facility capacity analysis based on development permitted by the County, projected population, and land use distributions based on the "Future Land Use Map," has not been completed. Recognizing the present inadequacy regarding surface water management in Monroe County, preparation of a Stormwater Management Master Plan is needed to assess the need for design of drainage systems in the developed portions of the County. This plan will be developed as a component of the Sanitary Wastewater/Stormwater Management Master Plan. The objectives of the Stormwater Management Master Plan include:

- assessing the adequacy of existing stormwater conveyance systems in developed or developing basins;
- prioritizing stormwater management needs of each island within a framework of the needs of the entire County; and
- developing a plan or identifying options available to the County on how to finance the cost of construction, operation, and maintenance of required stormwater management facilities.

Monroe County's present stormwater management practices have not been adequate to solve all of the problems associated with stormwater management. To this end, in an effort to provide control of water quantity, enhance water quality, and to effectively manage stormwater, the feasibility of creating a county-wide Stormwater Utility should be determined. Under the Utility, developed parcels of property would be assessed a fair and equitable user fee based upon that property's amount of impervious surface or other criteria. This user fee could then be used by the utility to correct existing deficiencies and provide for future facilities in the stormwater management system. The utility fee would also provide ongoing revenues for operation and maintenance of the public system.

B. Other Needs

- 1. Revise for adoption and implementation, Section 9.5-293 of the Monroe County Code which regulates stormwater management.**

Section 9.5-293 of the Code, as prepared by the SFRPC and the SFWMD was adopted by Monroe County in 1988. Subsequently, the DCA, which has final approval of County actions under the Area of Critical State Concern designation, appealed its adoption. Accordingly, implementation of this Code which

provides improved guidelines and criteria for the safe management and disposal of stormwater runoff in unincorporated areas has been prevented. Revisions will be considered which adequately address the DCA's concerns in the revised Land Development Regulations to be adopted concurrent with the Comprehensive Plan in order to implement improved stormwater management systems.

2. Continue and expand the assessment of ground water and surface water quality.

Until recently, little hard data on the impacts of urbanization of the Florida Keys on nearshore waters has been available. The results of recent studies clearly demonstrate that development is adversely affecting water quality in Monroe County. Continuing to rely on subjective evaluations may have irreversible consequences for the ecosystems of the County.

Monroe County should immediately approach the SFWMD and DER to embark on a joint comprehensive and long-term monitoring program of Florida Bay and the nearshore waters of the Florida Keys. This monitoring should be specifically designed to assess geographical and temporal distribution of water quality problems in Monroe County, and should have special focus on:

- (a) Appraising the efficacy and impact of the Everglades SWIM program on the character of freshwater discharge to the Florida Bay;
- (b) Expanding the water quality database for canals and nearshore waters to adequately define localized problems; and
- (c) Distinguishing the contribution of various point and nonpoint sources to water quality problems.

3. Prepare an inventory of drainage systems and performance data for all public and private systems within the County.

The Monroe County Department of Public Works should undertake the inventory and evaluation of existing drainage structures and facilities within county rights-of-way, and obtain data from the FDOT and municipalities for their facilities.

Section 9.5-293 of the Monroe County Code addresses only new construction as part of an application for development; no remedial action to remedy existing deficiencies is addressed. New construction of single-family and duplex homes in existing subdivisions must be required to have a stormwater management plan or use Best Management Practices. The Manual of Stormwater Management Practices, however, includes few BMP's appropriate for application to single lots. This concern will be addressed before DCA grants final approval of Section 9.5-293.

4. Evaluate the performance of systems constructed under the Monroe County Stormwater Management regulations.

The County should periodically sample the discharge from stormwater management systems to determine compliance with the water quality requirements of the County Code, and modify BMP recommendations as appropriate to improve the performance of future systems.

Although Section 9.5-273 requires evaluation of the stormwater quality and quantity impacts of proposed maintenance projects, no methodology for determining these impacts is included in the ordinance at the present time.

11.6 Adoption and Implementation of a Stormwater Management Ordinance

Section 9.5-293.1, Revisions of Surface Water Management Criteria of the adopted Monroe County Land Development Regulations sets forth the following Monroe County responsibility related to updating surface water management criteria:

The Monroe County Planning Commission shall consult with the Florida Department of Environmental Regulation and the South Florida Water Management District, and shall recommend a stormwater management ordinance for adoption by the Monroe County Board of County Commissioners which is consistent with chapter 17-25, Florida Administrative Code. Said recommendation shall be provided to the Board of County Commissioners pursuant to section 9.5-511 of this chapter within twelve (12) months of their effective date.

As an initial step in implementing the above referenced policies and Section 9.5-293 of the Monroe County Land Development Regulations, the Monroe County Planning Department is in the process of developing a Request for Qualifications entitled, "For the Development of Criteria Aimed at Controlling the Quality and Quantity of Stormwater Discharges from New and Existing Duplex and Single Family Home Development in Monroe County, Florida, and to provide Information for Distribution to the General Public Explaining the County's Proposed Stormwater Management Ordinance." The scope of services proposed for the development of the criteria for the stormwater management ordinance are as follows:

Task 1: Review and assessment of the stormwater management techniques used in the development of typical duplex and single family homes in Monroe County over the last twenty years.

Task 2: Prioritization of project areas (residential subdivisions) most in need of implementation of stormwater management criteria.

Task 3: Using the information developed in Tasks 1 and 2, creation and refinement of specific yet simple stormwater management criteria applicable to a) the development of new duplex and single-family homes and b) retrofitting of existing duplex and single family homes. The criteria must demonstrate the ability to be implemented through effective, practical, and cost-effective stormwater management procedures and techniques. Procedures and techniques to control

stormwater are to be implementable within the site planning, construction, and retrofitting stages of single family and duplex home sites. The intent of these procedures and techniques is to improve the quality of the nearshore waters of Monroe County.

Task 4: Alternatives analysis of all criteria, procedures, and techniques identified in Task 3.

Task 5: Development of a layman's brochure for distribution to the general public explaining the implementation of the criteria developed in Task 3 above, in addition to the County's proposed Stormwater Management Ordinance.

Monroe County expects to complete and adopt the Stormwater Management Ordinance concurrent with adoption of the Comprehensive Plan.

Current surface water management criteria contained in the Monroe County Land Development Regulations (Section 9.5-293) are as follows:

- (a) All surface water generated by a rainfall event of a three year return frequency shall be retained on-site.
- (b) All land adjacent to any body of water shall be finished and graded so that surface water runoff generated by a twenty-five year rainfall event will not discharge directly into a surface body of water.
- (c) To the maximum extent practicable, surface water shall be stored, controlled and directed so as to provide maximum water use in the support of natural or landscape vegetation (Ordinance No. 33-1986, Section 9-503).

As an interim ordinance, pending the completion of a county-wide Stormwater Management Master Plan, Section 9.5-293 only applies to new construction and does not address retrofitting of existing facilities or redevelopment activities. The Stormwater Management Master Plan as proposed would develop required criteria related to retrofitting of existing developed areas. The proposal for the development of stormwater discharge criteria should specifically address the 50 percent additional treatment which must be provided for water discharged to Outstanding Florida Waters as required by Section 17-25.025(9), F.A.C. and the means by which the criteria will serve to maintain the water quality standards specified in Chapter 17-302.500, F.A.C.

11.7 Sanitary Wastewater/Stormwater Management Master Plan

Numerous purpose and site specific studies have been conducted regarding the use and effect of various sewage treatment and disposal systems in Monroe County. In addition, no comprehensive study of drainage systems and stormwater management systems have been conducted. Many of these research efforts have been directed at identifying specific impact areas or biotic communities in the nearshore waters of Monroe County while not being designed specifically to identify the causative discharge points which, in most cases, were beyond the scope of these studies. Although these studies will be reviewed and when applicable be incorporated in the Sanitary Wastewater/Stormwater Management Master Plan (SW/SMMP) design methodology, it is now recognized that, in order to properly address the issue of

preventing environmental degradation resulting from effluent disposal and stormwater runoff, a comprehensive effort beyond the magnitude of anything yet undertaken will be required. Implementation of the SW/SMMP will affect the fiscal, regulatory and public and private operational characteristics presently in place related to drainage and sewage treatment systems utilized in Monroe County. Successful development and implementation of the SW/SMMP will require utilization of the coordinated expertise of both the engineering and scientific disciplines as well as the commitment to finance the study at a level that allows the necessary research and testing to be conducted in a manner that allows definitive conclusions and recommendations to be developed. The success of the study also requires that the fiscal and political commitments at varying levels, both governmental and regulatory, remain in place throughout the duration of development and implementation phases.

Section 9.5-293 of the Monroe County Code addresses the drainage requirements of only new construction, with no remedial action to address existing deficiencies or existing development. Both policy direction established by the Monroe County Board of County Commissioners on February 4, 1991 and the Stipulated Agreement between the County and DCA require development and implementation of a County-wide SW/SMMP which includes a Stormwater Management component. The end result of the Stormwater Management component of the Master Plan is to provide an adequate and equitable means for construction of a comprehensive, long-term, surface water management system which would address existing as well as new development. Through the Stormwater Utility, landowners would only be assessed equitable fees to provide for the facilities needed to accommodate the stormwater runoff generated as a result of the development of their own properties.

The goal of the SW/SMMP is to identify and quantify potential sources of pollution due to wastewater disposal and stormwater runoff and reduce the associated water quality degradation in the Florida Keys. Because of the interrelated nature of wastewater effluent discharge and stormwater runoff effects on water quality and in order to maximize the cost effectiveness of the Plan, the SW/SMMP will address both wastewater treatment and stormwater management. The plan will ultimately define the type of wastewater treatment and disposal methods and stormwater management techniques to be utilized by geographic service area. Allowable densities as permitted through the Land Development Regulations will be a primary criteria in defining the types of treatment systems and may preclude the use of certain systems in areas characterized by high density development. The conclusions of SW/SMMP will be integrated through the amendment process into the Comprehensive Plan. The Monroe County efforts will be integrated with the activities of National Oceanic and Atmospheric Administration's (NOAA) Marine Sanctuaries Program (MSP) which was initiated in October 1990. This goal will be accomplished over the next four years as outlined below.

11.7.1 Phase One: Design, Analysis and Approval of Water Quality Monitoring Network (March 1992 - September 1992)

In order for Monroe County to benefit financially by coordinating its efforts with those of the MSP and to meet the requirements of the Stipulated Agreement between the County and DCA, it is imperative that Phase One be initiated by March of 1992. The MSP is undertaking the collection and synthesis of a voluminous data base pertaining to water quality degradation and its effects on the biota. Many of the components of the MSP, especially the data gathering and analysis efforts, will parallel the data requirements of the SW/SMMP. By integrating the County's master planning efforts and time frame for completion with the MSP schedule the efforts of both entities can be complemented in terms of available expertise. In addition, the integrated effort will allow for the coordination of conclusions and implementation activities.

A. Defining the Research Parameters and Data Collection Methodology

Based on initial coordination meetings conducted between the Monroe County Comprehensive Plan and Marine Sanctuaries planning teams, it is evident that much of the data required to complete the SW/SMMP has been and continues to be generated by previously conducted research efforts and the present MSP activities. Much of the previously conducted research efforts were site specific with the hypothesis goals not specifically applicable to the data analysis and comprehensive conclusion requirements of the SW/SMMP. Further the MSP water quality research efforts are an integral component of the overall SW/SMMP process but must be complemented with data collection and analysis specific to wastewater issues and related effects. The Monroe County/MSP coordination effort must continue on a routine basis in order to assure that the best data is available in a manner that complements the efforts of both entities. If Monroe County is not able to initiate development of the SW/SMMP in a manner that parallels the MSP water quality data collection and analysis efforts in terms of the research, time frames the ability to take full advantage of this data may be endangered because of differences in methodology.

B. Data Organization

The SW/SMMP efforts will, because of its complexity in terms of the amount and diversity of the data collected, be best served through utilization of a Geographical Information System (GIS). Establishment of the database on the GIS will facilitate subsequent data analysis, utilization and interpretation throughout and beyond the planning process. The database is expected to consist of at a minimum the location and specifications of existing sanitary wastewater treatment facilities, location, type and quantity of discharge, associated discharge quality parameters such as bacteriological quality, nutrient loading, BOD, COD, metals, TSS, and toxic or hazardous components. Biotic samples will be collected from various target populations or communities and will be analyzed for species composition and diversity, standing crop, biomass and individual organism condition. The initial data collection and utilization of GIS will establish the database from which ongoing planning and management decisions can be made. Modifications to the database can be easily incorporated as needed based on interactive data analysis.

3. Remote Sensing

Various remote sensing techniques will be employed to identify specific features and surface water quality conditions such as algal blooms, thermal plumes, turbid water plumes, denuded substrata in shallow

waters, and previously identified discharges. The technique is particularly useful in identifying specific impact loci with onshore discharges thereby relating cause and effect mechanisms. Florescent tracer dyes will be utilized as appropriate to enhance the location of various plumes and generally improve on the usefulness of the data generated by this technique. This feature will enhance the design team's ability to select the most appropriate data and station locations for impact analysis and minimization.

D. Selection and Approval of Data Parameters and Monitoring Stations

Based upon the results of the previously discussed research effort, a specific data collection protocol will be designed which will meet the data requirements and the SWSMMP's objective of improving nearshore water quality. By incorporating the data generated during the source analysis with previously known and project identified impact areas, the number and location of monitoring stations can be kept to a minimum while still providing the necessary information so that informed decisions can be made. To ensure the scientific validity of the study design, a comprehensive review of the monitoring protocol will be undertaken by the appropriate governmental entities and the scientific community during these initial states of the planning effort. This effort will attempt to eliminate the possibility of design team subjectivity affecting important environmental monitoring protocol design decisions. In conjunction with HRS, experimental and prototypic alternative OSDS will be selected for evaluation in Phase Two of this study.

E. Funding Sources

The Florida Keys has been designated a National Marine Sanctuary, Outstanding Florida Waters, and an Area of Critical State Concern. In addition, the Nature Conservancy has designated the Keys one of the ten most significant ecological communities in the world. The importance of these designations and the Florida Keys initiative facilitates the identification and acquisition of support funding. Significant initial work effort will be directed to identifying potential funding sources on the federal, state and private levels.

The Florida Keys National Marine Sanctuary Program has in the Phase II, Task 5 - Funding Sources Report (September, 1992) identified potential sources of funding for implementation of any necessary institutional and corrective actions related to water quality. The information used in this report has been gathered from review of Florida State regulations related to funding and analysis of funding options used in similar activities. This report should serve as an inventory of potential options that can be used to address certain aspects of the water quality issues in the FKNMS. (Batelle. September, 1992 draft).

A wide range of options have been identified for addressing water quality issues in the Keys. The agencies and institutions that will be involved in implementing these options are diverse in terms of capabilities and resources. Many of the funding mechanisms discussed in this report could be used to address a number of different management and engineering options, and it will be the task of the agencies and institutions involved to determine which options are available to them. At this stage in the development of management plans for the FKNMS, no single preferred option, or set of options, has been recommended for addressing water quality issues in the Keys. Because of this, it is difficult to determine the type and level of funding and the effect it will have on the local economy. For this reason, this report does not recommend a specific suite of funding options to use nor does it contain an

extensive analysis of economic impacts or potential revenue generation. (Batelle, September, 1992 draft).

Following is a list of the potential funding sources identified in the Draft Task 5-Funding Sources Report:

Municipal Bonds

- General Obligation Bonds
- Revenue Bonds
- Certificates of Participation
- Pooled Bonds
- Private Activity Bonds

Tax Finance

- Florida State Level Tax Revenue
- Florida Local Level Tax Revenue
- Taxation Related to Water Quality Improvement
 - Cigarette and Other Tobacco Products Tax
 - Utilities Tax
 - Motor Fuels and Petroleum Production Taxes
 - Tourist Development and Impact Taxes
 - Foodfish and Shellfish Taxes
 - Litter Control Tax
 - Aquatic Lands Leasehold Tax
 - Pollutants Tax
 - Impact Taxes
 - Property Taxes
 - Sales Tax Surtaxes

Grants and Loans

Federal

- U.S. Environmental Protection Agency (EPA)
- U.S. Department of Agriculture
- Department of Housing and Urban Development
- National Park Service
- U.S. Department of Commerce

State

Rates

- Utility Rates
 - Capacity Futures
- On-Site Sewage Disposal Systems

Fees

- User Fees
 - Moorage Fees and Privilege Fees
 - Discharge and Run-Off Fees
 - Inspection Fees
- Tolls
- Impact Fees

- Development Fees
- Use Impact Fees
- Fines and Penalties
- Licenses and Permits
- Fishing and Hunting
- Boat Licenses and Registration
- Permits
- Special Assessments
- Donations/Charitable Trusts
- Privatization
- Operations Contracting
- Construction and Operations Contracting

11.7.2 Phase Two: Data Collection, Monitoring and Analysis (October 1992 - September 1994)

The magnitude of the water quality program has been generally identified but it is dependent upon the findings of the Phase One analysis. Phase Two, Data Collection, Monitoring and Analysis, consists of undertaking the vast majority of data gathering primarily associated with the environmental quality monitoring programs.

A. Establishment of Monitoring Stations

The monitoring station locations will be established in the field and permanently identified by one of several techniques. Discrete artificial canal, nearshore, offshore or deep water reference stations will be recorded by physical means in the field as well as electronic means within the GIS system. The productibility and subsequent trend analysis of the collected data are directly dependent upon the successful location of all sampling stations. It is therefore imperative that all stations be easily accessible and replaceable under varying climatic conditions. Aquatic, estuarine and marine monitoring will be conducted by a combination of sample collection and off site analyses as well as in situ analyses.

B. Water Quality Sampling

Water quality samples will be collected and analyzed for the previously identified parameters from all stations at least quarterly and in direct relationship to, specific conditions which directly impact nearshore water quality. Such conditions include, but are not necessarily limited to catastrophic spills, abnormal tidal conditions, local and near field storm events and special events.

C. Biotic Community Sampling

Various biological samples will be collected both from the water column as well as benthic substrate. These collections will include both faunal and floral associations to produce a broad based data set. These samples will be collected from the previously identified water quality sampling stations or appropriate reliable near field locations. The purpose of these collections will be to identify the health of the

individual organisms as well as the health of the community associated with the specific water quality at that station.

D. Soil Samples

During the collection of benthic substrata samples offshore substrata collections will be made in order to identify associated geophysical conditions. On shore soil borings will be performed to identify specific soil conditions and to determine their hydrogeological properties relative to transmissivity, bacteriological attenuation, nutrient uptake, and adsorptive and absorptive capacities. These stations will be located as a result of facilities location reviews. Based on a review of soils diversity throughout the Keys, sufficient samples will be taken to identify soil specific features and eliminate monitoring protocol induced variability.

E. Septic Tank Sampling

Evaluations of the performance of existing septic tanks at various locations and under varying soil conditions will be undertaken. The level of allowable density the system is expected to serve will be a consideration in the septic tank sampling and evaluation. The evaluation will consist of treatment effectiveness, effluent hydrology and the relationship to the soil sample analysis described in Section 11.7.2D above.

F. Wastewater Treatment and Disposal Methods Evaluation

The following treatment and disposal systems will be evaluated based on the future land use scenario, associated allowable densities, and the adaptability to environmental constraints. Treatment methods that will be evaluated include, but are not limited to, standard septic tanks, aerobic units, alternative OSDS, package treatment plants (secondary treatment, AWT, nutrient removal), and regional wastewater treatment plants. Effluent disposal options to be evaluated will include recharge, shallow and deep well injection, ocean discharge, irrigation reuse and wetland discharge.

G. Evaluation of Alternative OSDS

Alternative OSDS will be identified and tested under actual operating conditions. These test systems will be installed under the HRS guidelines contained in Chapter 10D-6.049 FAC. These guidelines specifies that the use of an experimental system may require the establishment of procedures for routine maintenance, operational surveillance and environmental monitoring to ensure that the system is functioning properly. Alternative OSDS will be evaluated based on treatment effectiveness, specifically nutrient removal, and economic feasibility. To confirm the effectiveness of any alternative OSDS the monitoring of discharges will be conducted for identical parameters and at the frequency utilized in the previously discussed water quality monitoring efforts. The discharges will be sampled for water quality parameters including bacteriological quality, nutrient concentrations, BOD, COD, metals, TSS, and specific constituents added to the treatment process for effectiveness tracking purposes or identified in the Phase One data analysis effort. It is expected that this monitoring and evaluation program will take a minimum of two years and should be initiated at the onset of Phase Two of the SW/SMMP.

H. Remote Sensing

Some of all of the following techniques will be utilized, as appropriate, in order to ascertain areas of discharge into surface waters that will require on site field analysis: color infrared aerial photography, multi spectral high altitude or satellite imagery, vertical black and white photography and other techniques which may be identified during the Phase One project design. Following the identification of important discharge points, florescent tracer dyes will be utilized to confirm target areas of the nearshore waters which will be analyzed. The identification process may include both remote sensing techniques as well as water borne sampling to identify the aerial extent and time of passage of individual discharge plumes. This effort will be valuable in identifying specific parameters which will be analyzed for in the sediment and water column. The associated sessile biotic assemblage entrained within continuous plume areas will yield further valuable data on the realized affects of the measured discharge constituents. By interrelating data generated on the biota and discharge parameters, informed decisions can be made regarding the source discharge.

I. Phase Two Conclusions

Utilizing the data collected during Phase Two and the subsequent analysis and conclusions the policies and parameters which will serve as the basis for development of the SW/SMMP will be stipulated. These conclusions are expected to confirm or rescind hypotheses associated with type and performance of OSDS applicable to the specific conditions, the use of boreholes, stormwater runoff attenuation, water quality trends identified in ongoing monitoring, recommendations associated with effluent treatment levels for each type of system, and the systems' ongoing appropriateness in the Keys environment. The conclusions will be based upon information generated by the SW/SMMP, as well as other ongoing or recently completed ecological analyses of the nearshore region of the Florida Keys. As previously stated this effort will incorporate the cause and effect relationships between discharges, water quality degradation, and biotic impacts or responses.

11.7.3 Phase Three: Development of the Sanitary Wastewater/Stormwater Management Master Plan (October 1994 - September 1995)

A. Presentation of Findings and Conclusions

A working paper containing the results of the Phase Two Conclusions will be developed to present the findings of the study to the entities having jurisdiction and interest in minimization of water quality degradation. Based on these findings, the paper will contain the recommended policies and parameters for final development of the SW/SMMP. Results of the governmental agency/public review and any additional relevant input will be utilized to solidify these policies and parameters.

B. Final Development of the Sanitary Wastewater/Stormwater Management Master Plan

The Sanitary Wastewater Element of the SW/SMMP will contain the following components:

- The ultimate type of treatment and effluent disposal systems to be utilized by geographic service area will be identified and graphically depicted.

- Mandatory level of treatments for new and replacement systems including the criteria for attaining the adopted level.
- Schematic depiction and estimated construction costs associated with any necessary major support infrastructure for sanitary sewer facilities.
- Potential funding sources available to implement required capital improvements program associated with the recommendations contained in the Master Plan.
- Proposed rate structure for publicly owned and operated sewer systems.
- Recommendations for retrofitting specific existing facility deficiencies found to be causing significant water quality degradation and development of associated costs.
- Recommended ongoing monitoring program, beyond the adoption of the Sanitary Wastewater Component of the SW/SMMP, designed to assess the effectiveness of improvements and amended levels of service on environmental conditions.

The Stormwater Management element of the SW/SMMP will contain the following components:

- Recommendations for retrofitting specific existing facility deficiencies found to not be meeting the adopted levels of service standards.
- Evaluation of the establishment of a Stormwater Utility as an equitable means of implementing the identified stormwater management improvements.
- Recommended ongoing monitoring program beyond the adoption of the Stormwater Management component of the SW/SMMP to assess the effect of implementing stormwater management improvements and amended levels of service on environmental conditions.

11.8 Level of Service (LOS) Standards

The level of service standards for drainage meet or exceed the requirements set forth in Chapter 17-25 F.A.C. The adoption of those standards is a prudent measure pending the completion of the county-wide Stormwater Management Master Plan. Specific references(s) to Section 17-25(9), F.A.C. for Outstanding Florida Waters and to maintain the water quality standards specified in Chapter 17-302, Section 17-302.500, F.A.C. will delineate the specific standards in effect related to adopted levels of service. The levels of service standards can only be applied to development having drainage systems permitted after the adoption of Section 9.5-293 of the Monroe County Code and cannot be immediately applied to the vast number of unpermitted drainage system or developments not having drainage systems. Objections raised regarding stormwater quality monitoring can only be addressed through the criteria utilized to develop the

county-wide Stormwater Master Plan. The level of service standards are described in Sections 11.8.1, 11.8.2 and 11.8.3.

11.8.1 Water Quantity Level of Service Standards

The following protection levels for development are based upon design storm frequency and duration:

- (a) Residential and commercial building floors - 100 year, 3 day; (SFWMD Water Quantity Criteria, 3.2.1.4)
- (b) Emergency shelters/service building floors - 100 year, 3 day; (SFWMD Water Quantity Criteria, 3.2.1.4)
- (c) Evacuation routes and emergency service road - 100 year, 3 day; (SFWMD Water Quantity, 3.2.1.4)
- (d) Arterial roads - 100 year, 3 day; (SFWMD Water Quantity Criteria, 3.2.1.4)
- (e) Collector roads - 25 year, 3 day; (SFWMD Water Quantity Criteria, 3.2.1.2)
- (f) Neighborhood roads - 5 year, 1 day; (SFWMD Water Quantity Criteria, 3.2.1.3)
- (g) Urban sites - 5 year, 1 day; (Local Requirement)
- (h) Rural sites - 3 year, 1 day; (Local Requirement)
- (i) Off-site discharge rates shall be limited to historic, predevelopment conditions or as previously determined by the SFWMD or the County.

11.8.2 Water Quality Level of Service Standards

- (a) Development shall ensure that stormwater discharges will meet State water quality standards as set forth in Chapter 17-25, Florida Administrative Code.

Wet detention basins shall have a minimum volume equal to one inch of runoff from the entire site or 2.5 inches from the impervious portion, whichever is greater. Dry detention basins shall have a minimum volume equal to 75 percent of that required for wet detention.

Retention volume shall be provided equal to fifty percent of the wet detention requirement.

11.8.3 Retention/Detention Criteria (SFWMD Water Quality Criteria, 3.2.2.2)

Current retention/detention criteria in effect in Monroe County are as follows:

- (a) Retention and/or detention in the overall system, including swales, lakes, canals greenways, etc., shall be provided for one of the three following criteria or equivalent combinations thereof:
 - (1) Wet detention volume shall be provided for the first inch of runoff from the developed project, or the total runoff of 2.5 inches times the percentage of imperviousness, whichever is greater.
 - (2) Dry detention volume shall be provided equal to 75 percent of the above amount computed for wet detention.

- (3) Retention volume shall be provided equal to 50 percent of the above amounts computed for wet detention.
- (b) Stormwater discharge facilities which directly discharge to Outstanding Florida Waters shall include an additional 50 percent of the water quality treatment specified in Section 11.7.3. Required water quality volume shall be calculated by multiplying the volume obtained in as specified in (a) above by a factor of 1.5.

11.8.4 Present and Projected Future Ability to Meet Level of Service Standards

Adoption of the established SFWMD water quantity and quality drainage criteria and related Florida Administrative Code water quality requirements in conjunction with the implementation of the revisions to Section 9.5-293, Surface Water Management Criteria of the Land Development Regulations, will allow for drainage requirement criteria to be imposed on a site specific basis. Adoption and implementation of the revisions to Section 9.5-293 of the Land Development Regulations will allow for imposition of stormwater management criteria on development exempted from SFWMD requirements because of site characteristic such as size and impervious area.

11.8.5 Key Carrying Capacity Limitations, Facility Inadequacies, and Policy Constraints

Those projects exempt from SFWMD permitting requirements are subject to local criteria which is presently not being enforced. The present policy of project by project permitting does not reflect an integrated surface water management system which may result from the Stormwater Management Master Plan. The interim stormwater management levels of service and permitting process, although an improvement over past neglect, do not address existing deficiencies or the integration of drainage facilities on a greater than individual permit basis. The Stormwater Management Master Plan is necessary to address existing deficiencies and, as necessary, to identify existing inadequate facilities which require retrofitting. The Stormwater Ordinance presently under development can be considered the initial phase of the Stormwater Management Master Plan. This ordinance will establish criteria that will be utilized for development of the Stormwater Management Master Plan.